

# **Mainstreaming of Developmental Education: Supplemental Instruction<sup>®</sup> and Video-based Supplemental Instruction<sup>®</sup>**

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## Historical Beginnings

What do you do to reduce student attrition when there is negligible funding and your faculty will not permit remedial or developmental coursework?

This was the question asked by the UMKC university-wide retention committee in 1972. The response to that question initiated the program known as Supplemental Instruction<sup>®</sup> (SI) and the more recent Video-based Supplemental Instruction<sup>®</sup> (VSI).

The context of this question sets an important framework for our paper. A decade earlier, the University of Missouri had reached out to a small, private university in Kansas City along with several private professional schools and a private conservatory of music. The resultant amalgamation and reorganization produced the University of Missouri - Kansas City. As a public institution, UMKC faced some difficult adjustments, the first of which was a change in patterns of student access. Instead of limiting the student clientele to the affluent top 20 percent of high school graduates, the university now offered admission to a much more culturally and academically diverse population. This change was particularly difficult for many of the faculty who had come to the university precisely because the students were carefully selected and well prepared for the rigors of academic study. Thus it came as no great surprise when the overall attrition rate rose from the 20 percent it had been in the private college days to the 45 percent that became standard among entering University of Missouri students (Widmar, 1994, p. 4).

From 1963 to 1972, possible remedies for the high attrition rate were investigated and rejected by various individuals and groups. Two ever-present factors served as institutional barriers: 1) Missouri was then and remains to this day 48th among the States in funding for higher education; therefore, the solution had to be both inexpensive and cost effective; and 2) while the faculty had to accept a more diverse student population, they would not add remedial or developmental courses to the curriculum. The advice to add such courses was “state of the art” in those days, especially given the mismatch between faculty expectations and student skills. The faculty’s standard response to the advice was unwavering, “Students with remedial needs should enroll in the community college, not the University.” That, too, has remained unchanged.

The faculty members on the retention committee argued that any available funding should go directly into the departmental budgets since the faculty were the ones who had regular, sustained contact with the students in the classrooms. Faculty believed they were best equipped to meet student needs. The administrators

countered that when they gave the departments funding for teaching improvement and tutoring, the grades and attrition statistics remained unchanged. The faculty countered with the argument that if they only had better students, these discussions would be moot. What the committee could agree upon was a need to evaluate rigorously any future effort to support student learning. Martin proposed a compromise plan and the committee, more from exhaustion than from conviction, agreed to pilot the program that became SI.

## Description of SI

SI provides an efficient and convenient opportunity for students to meet both academic and social agendas. Student groups convene on a voluntary basis at times convenient to a majority of the students in the class who express interest in small group study. These groups typically demonstrate heterogeneity with respect to academic and demographic characteristics. The informal study groups convene initially during the first week of class and continue throughout the semester. A student leader, having previously studied that subject, earned high marks, and received the approval of the course professor, assists those who have enrolled in the targeted class. Before meeting the class, the SI leader participates in a structured training and supervision program designed to introduce the leader to the SI program and the use of collaborative learning techniques.

The SI leader attends every class. During SI, the leader helps students by facilitating discussions focused on the concepts, requirements, and other components of the course that the students may find daunting. The leader avoids re-lecturing to students, preferring to use a variety of small group learning strategies designed to enhance study and reasoning skills. At the same time students engage in productive dialogue about course concepts and assignments.

Working collaboratively, students figure out answers to questions that arise. Unresolved questions or issues are taken by one or more students to the professor. Subsequently, they return with answers and share these with the SI group.

As exams approach, students are assisted by the leader to predict exam questions and practice answering them. While SI leaders are involved in neither constructing exam questions nor grading exam papers, they do draw from their own experiences

to prepare groups for tests. Often the professor will assist by preparing practice exams for the entire class.

### The Committee Endorses SI

The idea of SI appealed to the UMKC retention committee for several reasons. First, SI could be evaluated in terms of reduced attrition and grade improvement in core curriculum courses. If the percentages of top grades rose in these courses and the D, F, and Withdrawals fell, it might be reasonable to conclude that SI made a difference in otherwise stable courses. The committee suggested controlling for motivation, instructor/professor, type of test, text, grading standards, and various academic and demographic factors. The committee recognized that SI would not be perceived as remedial by students or faculty if it began during the first week of class before any exams had identified student weaknesses and if it were open to all students in the class on a voluntary basis. The faculty committee members also liked the concept because SI cost little to pilot and required a minimum of faculty time. Lastly, the committee liked the idea that SI promoted independent learning on the part of the students (Arendale, 1997a; Blanc et al, 1983 Kenney, 1989; Widmar, 1994).

Following its adoption by the faculty in 1973, SI has enjoyed nearly a quarter of a century of uninterrupted service to students and faculty. Faculty support SI not only because it improves student performance but also because it increases student interest and involvement in the classroom discussion. Further, they report receiving fewer complaints about the most challenging courses they teach (Bryngfors & Bruzell-Nilsson, 1997; Gardiner, 1996; King, 1994; and Wolfe, 1988).

To the extent that they meet with the SI leaders, faculty receive timely feedback about the problems and difficulties their students encounter. In fact, some universities have adopted SI specifically because it promotes better teaching.

### Conceptual/Theoretical Framework for SI

In 1973, when the committee chose to pilot the new approach proposed by Martin which became Supplemental Instruction, they were aware that the process had its roots in the formation of informal, collaborative learning groups attached to historically difficult courses.

Research and writing in intellectual development (Arons, Perry, and Piaget), metacognition (Weinstein & Stone, in press), and college student development and retention (Light, 1990; Sandberg, 1990) support the empirical framework upon which SI is based. "In every comparison of how much students learn when they work in small groups or when they work alone, small groups showed the best outcomes" (Light, 1990, p. 10). Such collaborative experiences improved both the cognitive and affective domains of students (Sandberg, 1990). "The student's peer group is the single most potent source of influence on growth and development during the undergraduate years" (Astin, 1993, p. 398). Studies in metacognition suggest that students must assume the role of "self-regulated learners" to both persist in college and master difficult academic subject matter (Weinstein and Stone, In press). The SI model reflects a practical implementation of dealing with themes of attrition identified by Tinto (1997, 1993) and other researchers.

SI draws further support from Kemig who developed a "Hierarchy of Learning Improvement Programs." The lowest rank in effectiveness was assigned to remedial courses that taught skills in isolation. Programs similar to SI were ranked near the top of the effectiveness scale since, ". . . students' learning needs are presented as being necessary because of the nature of the objectives and content of the course rather than because of students' deficiencies." (Kemig, 1983, p. 23).

In those early days, having recently emerged from the 1960's and the world view that predominated among young academics, we sought a theory base that placed the responsibility for student achievement on the academic support personnel. This was not an "open admissions" university, and we believed that if the university accepted students, the students could do the work. And if they couldn't, it was because of institutional barriers, not deficits in the students. As representatives of the institution, we wanted to demonstrate the university's commitment to those who met admissions criteria. We also wanted to involve the faculty as participants in the solution, eliciting their approval of our presence on their most sacred ground: the classroom.

### **More Time and More Efficient Use of Time for Mastery Learning**

SI extends the classroom walls and expands the classroom time for additional study and mastery of content material. In 1994, the National Education Commission on Time and Learning (NECTL) issued its findings regarding learning improvement.

While findings were directed at K-12 education, they also apply to higher education. "Time is the missing element in our great national debate about learning and the need for higher standards for all students. Our schools and the people involved -- students, teachers, administrators, parents, and staff -- are prisoners of time, captives of the school clocking calendar" (Kane, 1994, p. 7). NECTL announced its first recommendation: reinvent schools around learning, not time. While knowledge doubles every few years, the academic calendar and number of class periods has remained fixed for more than a generation. A comparison of the total number of hours of instruction provided in required core classes during their final four years of secondary school suggests a major reason for the disparity of academic performance among U.S. citizens when compared with those from three other major industrialized countries: U.S., 1460 hours; Japan, 3170 hours; France, 3280 hours; Germany, 3528 hours (Kane, 1994).

Studies indicate that differences in required learning time increase as slower students progress through the curriculum. "A student who begins a learning sequence by performing poorly on the first step performs even more poorly on the second step because he lacks some of the prerequisites. Without extra time to restudy these prerequisites, he misses more prerequisites at each successive step, becoming progressively farther behind. So the academically rich get richer get richer and the academically poor get poorer" (Arlin, 1984, p. 67).

### National and International Dissemination of SI

Initially, SI was implemented in the UMKC health science schools and later extended to undergraduate classes with an emphasis on the College of Arts and Sciences. After a rigorous review process in 1981, the SI program became one of the few postsecondary programs to be designated by the U.S. Department of Education as an Exemplary Educational Program. SI is the only program validated by USDOE to improve both student academic achievement and graduation rates. The National Diffusion Network (NDN), the national dissemination agency for the U.S. Department of Education, provided federal funds for dissemination of SI for fifteen years until the NDN was dismantled in 1996. National and international dissemination continues, however, supported by registration fees for training and UMKC.

As of November 1997 more than 1,400 faculty and staff from 810 institutions across the nation and 115 institutions in 12 countries have received training to

enable them to implement their own SI program. Based on estimates from 149 institutions regularly tracked by the National Center, approximately 350,000 students participate in SI each semester. At some institutions, SI is the only academic service provided. Other institutions add SI to traditional developmental education classes and individual tutoring (Commander, et al, 1996, Stratton, 1997).

The National Center for SI is well equipped to respond to requests for SI awareness materials, training, and technical assistance. The center conducts four workshops each year in Kansas City and others at various universities in the U.S. and abroad. Typically, these three-day workshops bring together faculty and staff from several institutions. The center staff also conduct customized, on-site workshops by special arrangement. In addition to printed materials, the center provides newsletters, video tapes, and a web page for awareness and training purposes.

Other training teams led by Certified Trainers are located throughout the U.S. and in the United Kingdom, Sweden, South Africa, and Australia. Though UMKC serves as the main demonstration site, all Certified Trainers and many active SI supervisors host interested visitors on their campuses.

### Cost Effectiveness of SI

To estimate the cost of implementing SI at an institution, three factors must be considered. First, will the institution employ new personnel to implement the program, or can it use existing personnel? Second, will the SI supervisor need assistance from other personnel? Third, what types of support will be forthcoming from the adopting institution in terms of released time, use of facilities, and funding?

The fiscal return to the university far exceeds the cost of the SI program if one considers the following three factors: first, the university's available spaces are not fully subscribed, and therefore each student who leaves the university takes with him/her the state funding and tuition which support the student's attendance; secondly, analysis permits estimates of the numbers of students who persist as a consequence of involvement with the SI program; finally, the costs of the SI program are carefully documented. At UMKC, the administration estimates that

money invested in the SI program returns 150-200 percent in fiscal support. Components of the cost-benefit equation include the average amount of annual student tuition and fees, the number of students involved with the SI program, the improved differential of reenrollment rates of SI participants when compared with non-participants, and other factors (Martin and Arendale, 1993). Administration consider this estimate conservative since it is based on undergraduate students and takes into account only the single year following the student's participation in SI. The economic impact in graduate and professional schools is considerably greater since the number of spaces in those programs is limited and it is rarely possible to find a replacement for a student who withdraws following matriculation. Furthermore, both the cost and the tuition of these graduate, professional programs are far greater than those associated with undergraduate instruction.

### Claims of SI Effectiveness Validated by the U.S. Department of Education and Other Independent Research Studies

When the U.S. Department of Education designated SI as an Exemplary Educational Practice, the panel and its team of researchers and referees validated three statistically significant research findings: (1) Controlling for motivation, prior academic achievement, and the demographic variables which connote "non-traditional" (i.e., ethnicity, gender, marital status, extracurricular part time and full time employment, and age), students participating in SI within the targeted historically difficult courses earn between a half to a full letter grade higher than students who do not participate in SI. (2) Controlling for motivation and prior academic achievement, students participating in SI within targeted historically difficult courses succeed at a higher rate (i.e., withdraw at half the rate and receive half the percentage of D or F final course grades) than those who do not participate in SI. (3) Students participating in SI persist at the institution (reenrolling and graduating) at a rate ten percentage points higher than students who do not participate in SI (Blanc, Martin, & DeBuhr, 1983; Martin & Arendale, 1993).

Research studies based on the UMKC experience, reports in the national database from 270 institutions where SI has been adopted and implemented, and other studies from individual campuses support the claims of effectiveness of the SI model. Hundreds of colleges and universities submit data reports on their SI programs. These findings are remarkably similar to those drawn from the UMKC experience over 25 years. Additional studies revealing the impact of the SI program have been conducted in universities in the United Kingdom, Sweden,



Australia, and the Republic of South Africa. These studies are available through the SI home page: [www.umkc.edu/cad/si.htm](http://www.umkc.edu/cad/si.htm)

### Use of SI for Faculty Development and Renewal

In addition to helping students earn higher grades, the SI program has been effectively used for faculty development and renewal. Faculty may elect, for example, to attend portions of the SI leader training workshops, learning how to incorporate SI strategies into regular class activities (Martin, Blanc, & Arendale, 1994). Activities recommended to SI leaders have general utility in the classroom: be certain that students have the big picture of the course throughout the academic term, illustrate the process of solving problems and thinking about issues, refer to the syllabus throughout the academic term, include an early, low impact exam to provide feedback regarding comprehension before the first major exam, organize course content through visual tools (e.g., matrix organizers), and be explicit about expectations for excellence. Wolfe (1990) describes the use of SI at Anne Arundel Community College (Arnold, MD) to provide services for both students and faculty members. Some faculty members serve as SI supervisors. A faculty member who agrees to serve in this role is called a "Faculty Mentor." An important feature of this program is that the faculty member supervises SI leaders in areas outside the faculty member's content specialty. The faculty members focus on general learning skills and not on critiquing the lectures or assignments of their colleagues.

Only rarely do lecturers receive timely and useful feedback from students who fail to understand the content of their lectures. End-of-term evaluations come too late, after the weakest students have already left their course. In-class questions rarely request clarification. In an unpublished study based on observations, students in first-year lecture classes with enrollments greater than fifty asked an average of one question per class hour, and ninety per cent of those questions dealt with administrative concerns, e.g., the due date of an assignment, the time and place of the an exam.

Marshall (1994) and Wolfe (1990) observed that lecturers modify their behavior when they receive timely feedback from SI leaders regarding student comprehension and confusion. In class, many students find it difficult to articulate their content problems. Sometimes their understanding is not sufficient to permit them to ask a clarifying question. Some fear that raising a question reveals their own incompetence. Others fear that their questions may be interpreted as criticisms by a lecturer who determines their grades and, ultimately, promotion and graduation.

Marshall (1994) reported on the use of SI for faculty enrichment at Salem State College. The Salem scheme permitted frequent interaction between faculty members and SI leaders through joint participation in SI leader training workshops, monthly meetings to discuss pedagogical issues, and weekly meetings to address common content issues. Faculty members reported numerous changes in their behavior and improved attitudes. Although this aspect of SI in faculty development was studied intensively at Salem State College, the use of SI as a feedback mechanism leading to faculty development is more frequently used in Australia and the United Kingdom than in the U.S. (See web site for additional references.)

Additional benefits mentioned by Australian faculty members include these: increased rapport with students, membership in national and international SI network, increased recognition from their colleagues, additional opportunities to obtain grant funds, and increased satisfaction with their teaching role (Gardiner, 1996).

## **Video-based Supplemental Instruction (VSI)**

### **Initial Target Student Population for VSI**

The foregoing should not be interpreted to suggest that SI is a one-size-fits-all solution to academic problems. Data suggest that the SI experience can move a student's performance from below average to average, from average to above average, from above average to excellent. In the lower ranges of performance, it appears that participation in SI can elevate a student's grade from sub-marginal to below average. At UMKC as at other Universities, however, practitioners have found that there are students for whom SI offers insufficient support. Typically, these students fall at or near the bottom of the fourth quartile in terms of entry level scores and/or high school rank. SI is not scheduled often enough, nor does it have sufficient structure, breadth, or depth to meet the needs of this population. On other campuses, these students would typically be tracked into developmental courses which, for UMKC, has never been an option.

### **Description of VSI**

In order to retain the at-risk student population, we have developed an information delivery system called Video-based Supplemental Instruction or VSI<sup>®</sup> (Martin and Blanc, 1994). VSI differs from SI in several respects. The students enroll in required, core curriculum courses. The course professor records all didactic presentations on videotape for use with underprepared students as well as other students who opt for this highly interactive way of learning. Instead of attending the professor's regular lecture classes, students enroll in the video section of the professor's course. Students in both sections are held to the same performance standards. Specially designed facilitator and student manuals support the video sections.

VSI students, led by a trained facilitator, start and stop the videotaped presentation at pre-determined times and, in addition, whenever they have a question or want clarification. Professors design the video presentations to include periodic small group assignments to insure mastery of one concept before the next is introduced. Students complete these tasks under the supervision and with the guidance of the facilitator. When the taped lecture resumes, the professor models how he/she thinks about the assigned tasks. In this way, the students have time to construct and verify their understanding as well as compare their own thinking to that of the expert. As one student said, "When I sit in regular classes, I don't have to pay attention and even when I do, I'm often lost. In VSI I have to pay attention all the time and when I'm lost, my friends help me figure things out."

For a three credit-hour course, students enroll in an 8-9 hour block of time spread throughout the week. Students receive regular credit for the core curriculum course and, in some circumstances, 3 additional hours of credit for the reading, writing, critical thinking, and study skills that are embedded in VSI. In this way, we can integrate much of what is best about developmental education directly into the core curriculum. Students develop needed competencies as they earn credit toward their degrees. Student success is largely a matter of efficient time on task combined with effective guidance.

VSI captures and manages what we see as the great, untapped resource on all our campuses: the students' study time. Only in retrospect do students tell us that they learned how to study more effectively. Few of them recognize that they engaged in developmental education; skill development is so closely tied to the content that they don't perceive a separation (Martin & Blanc, 1994; Burmeister, 1996).

## Review of the Literature Concerning Programs Similar to VSI

Tutored Video Instruction (TVI) describes the use of video-taped lectures with a tutor to help students master the material. Dr. James Gibbons at Stanford University was the original developer of TVI in 1973 (Gibbons, et al., 1977). The method uses unrehearsed, unedited videotapes of regular classroom courses. Class size is kept small (3 to 10) and students receive assistance from a paraprofessional tutor who attends the video presentation with the other students. The original TVI course was developed to serve the needs of Hewlett-Packard employees at the Santa Rosa plant located about 100 miles from Stanford. Dipaolo (1995) reports the use of TVI since 1970 to deliver courses to business and industry at 25 sites throughout the U.S. Rather than bringing salespeople and others to a central site for weeks of inservice training, Hewlett-Packard is now using TVI to deliver training off-site (Forbes, 1994).

Bates (1989) describes the use of TVI with distance education courses for the British Open University and other members of the European Association of Distance Teaching Universities. Generally the videotape is played through to the end and then the tutor works with students via telephone to understand the presented material. Research by Bates (1987) identified the “one-third rule” that suggests that only about the one-third of learners are able to process such material by themselves. The next third of students knew that they needed to adjust their learning style but did not know how to analyze and interpret the course material. The remaining third of students were unaware that they needed to adjust their learning style and, consequently, failed to do so. The only students who achieved high marks were those in the first third mentioned above.

TVI has been successfully used in Australia since 1986 in delivery of first year degree programs in science, business and arts at Capricornia Institute (Appleton, et al., 1989). The tutor served as facilitator, motivator, and initiator of questions during the videotape playback. The tutor decides when to start and stop the videotape. Tutored Audio-Version Instruction (TAVI) is similar to TVI except that it uses audio-cassette tapes rather than video tapes (Sparkes, 1985). The audio or video tapes may be stopped periodically or are played until the lecture ends. Student interaction with the tutor follows.

### Student Subpopulations Served by VSI

While VSI has had many applications (Blanc & Martin, 1994; Burmeister, 1996; Landwehr, 1995; O'Donnell, 1996), perhaps the most dramatic example of the use of VSI with underprepared university students has been in the Republic of South Africa. At the University of the Orange Free State in Bloemfontein, RSA, Prof. Pieter Nel, concerned about the nearly total failure rate of underprepared, Black South African nursing students in the required subject of anatomy, made arrangements to record all the anatomy lectures on videotape. Students were enrolled in the lecture class, as usual. After the underprepared students failed the first exam, he shifted the failing students out of the regular lecture class and convened a VSI class based on the UMKC model. Students were given a trained facilitator and were scheduled to work on the material 3 hours each morning. The results revealed that the underprepared students performed on tests and final examinations at the same level as the better prepared students (Nel, et al., 1997).

At UMKC, the Institute for Professional Preparation uses VSI in the review undertaken by medical students in preparing for their national board examinations in the basic and clinical sciences. Approximately 350 medical students from across the nation enroll in these review programs on the UMKC campus, and an equal number enroll on their home campuses in the video-based courses prepared at UMKC. The VSI supervisors at the remote sites receive three days of training in Kansas City each year prior to their offering the review program on their campuses. Because of its high success rate with non-traditional students, the on-campus offerings of the Institute are always fully subscribed with extensive waiting lists.

At present, 32 rural Missouri high schools are using VSI for dual credit. Students on average earn grades that exceed those of the regular campus lecture section. Reports from the field maintain that VSI courses provide a bridge program for college bound students more powerful and satisfying than standard dual credit courses. High school faculty who serve as the course facilitators value the program because they deepen their understanding of both content and teaching effectiveness. UMKC values the program for its lucrative revenue stream and recruitment potential.

With reference to tertiary education, our goal has been to reduce attrition and increase the graduation rates among all students, with a special emphasis on underrepresented populations and at risk students. Our strategy has been to increase the level of student performance in historically difficult or gatekeeper courses, integrating what to learn with how to learn it, and endeavoring to insure that students actually understand and can transfer what they are learning. We have

attempted to do this in a way that is affordable to the institution, acceptable to the faculty, and respectful of students' time and financial resources.

### **National and International Dissemination of VSI**

As of November 1997 more than 100 faculty and staff from 40 institutions across the nation have received training to implement their own VSI programs. The National Center is well equipped to respond to requests for VSI awareness materials and training. The center conducts four workshops each year in Kansas City and several others are located at other locations in the U.S. and abroad. These three-day workshops bring together faculty and staff from different institutions. The center staff also conduct custom on-site workshops at institutions that wish to adopt the VSI model.

### **Research Findings Concerning VSI**

A comparison of data on student demographics and previous levels of academic achievement found that the VSI participants from UMKC had significantly lower standardized college entrance examination scores, significantly lower high school graduation percentile ranks, a significantly higher representation of students on academic probation, and a greater proportion of students with undeclared college majors (a common characteristic of college dropouts). Further analysis of achievement and withdrawal rates found that the VSI participants: earned significantly higher percentage of A & B final course grades; significantly lower percentage of D & F final course grades and withdrawals; and significantly higher mean final course grades than the students enrolled in the same large live course taught by the same professor. These results were higher than predicted since various predictors had suggested that the VSI students were less prepared academically and would perform at lower levels than the students enrolled in the large lecture class (Martin and Arendale, 1997).

### **Different Paradigm Position of SI and VSI in Comparison to Traditional Viewpoints**

In the first part of this paper, we have followed the traditional format of educational reporting. We defined our terms, described our method, and cited results in conventional terms. But in our view, SI and VSI are neither traditional nor conventional.

This final section of the paper connects our thinking with contemporary critics and articulates a philosophical base for SI and VSI. The following paragraphs trace what we see as a paradigm shift that has occurred and is occurring, one to which we educators concerned with the developmental needs of students must be sensitive if we are to continue to play a key role in postsecondary education.

### The Influence of Reductionism in Medical Education and Practice

Fritjof Capra, in his recent book, *The Web of Life*, draws a fascinating historical parallel between the development of modern medicine and the evolution of modern education. He describes the historical interaction between technology and medical practice which, in an interesting way, illuminates the educational issue that we believe the SI model addresses. Over the past fifty years, Capra notes, medicine has followed a reductionist pathway as developing technology permitted scientists to probe ever more precisely the elements comprising the human body. Previously, critical importance attached to anatomical studies because it was believed that physicians treated the human body and therefore must become acquainted with it and understand it in all its aspects.

In the 1950's and '60's, a new paradigm emerged and both physicians and medical educators recognized that the human body in fact comprised 10 or 11 systems, each essentially complete in itself, with some remote but essential connections between and among the systems. This paradigm led to the study of separate sciences of, for example, cardiology, endocrinology, and neurology, in recognition of the truth that the physician will logically treat one or another of these, or perhaps several simultaneously in the unusual event of multi-system disease.

The next two decades saw two more paradigm shifts. Among medical professionals and medical educators, an awareness grew that the medications available to treat human illness operated at the cellular level, acting either on the cells or upon the organelles which constitute essential elements of the cells. As a consequence of this reorientation, the central study in medical education shifted to the cellular level and cell biology became the key basic science that underlay the practice of medicine.

Developing technology now permits direct interaction between the scientist and the individual molecules which comprise the cell.

At the same time that biologists, chemists, biochemists, and allopathic physicians followed the reductionist pathway just described, osteopaths and others continued to pursue a holistic approach to human health. Deepak Chopra and Andrew Weill, to mention only two of the more recent advocates of holistic medicine, not only reject the concept of the separation of physiological systems; they reject even the separation of mind and body. Holistic practitioners hold that the individual can self-regulate, can mobilize physical and psychic resources to counter and overcome the effects of disease, and ultimately can achieve homeostasis. In this view, it is the person (not the surgeon, the medication, nor the transfusion) that triumphs over the disease.

### Reductionism Applied to Education

A reductionist pattern similar to that in medicine has been echoed by many in education over approximately the same time span. Early reductionists identified the "g factor" in intelligence and others subsequently subdivided intellect into seven or nine finite subcategories. Others recently tried to identify the precise quantity of intellect that derives from genetic transmission and the degree to which intellect is a product of environmental influences.

In remedial and developmental education, research scholars embracing the reductionist approach have sought first to identify the separate and distinct skills required for academic success, then to measure the degree to which these are present or absent in the individual, and finally to isolate and teach those skills that are in deficit. Practitioners have incorrectly assumed that mastery of a series of independent skills will lead to academic competency.

And how do students acquire skills? The traditional academic answer prescribes one or more prepackaged courses. Thus the student who wishes to study physics is told that the study of mechanics presupposes mastery of mathematics through calculus, a prescription that would certainly have befuddled the pre-Newtonian physicists!

Similarly, the student whose scores fall below accepted entrance criteria is told to take a prescribed series of developmental courses before being allowed into the mainstream core curriculum. Unfortunately, not all students have the time and



money to invest in such a long-term project. Lacking resources, most exit through a side door and never re-surface at the tertiary level. Thus the very population for whom remedial and developmental courses were designed, the poor, are among those least able to persist.

### SI and VSI: the Holistic Alternative

The contribution of Supplemental Instruction and its offspring, Video-based Supplemental Instruction to the educational process is that these two models break entirely with the reductionism of developmental education and attempt to provide a holistic approach to postsecondary education. In the environment of SI and VSI, the individual can activate the adaptive process which enables each of us to survive as strangers in a strange land. The SI or VSI leader is on hand to facilitate the adaptive process for the individual student, and, by extension, to help the peer group acquire those skills and attitudes consistent with academic success.

If we have a single criticism of developmental education as it has been practiced, it is that the traditional model fails to recognize the adaptive ability of the individual student and does not regard her/him as a person whose ability to self-regulate can be extended to the academic challenge. But everyone, and especially developmental educators, know that a person is more than a collection of skills. Given sufficient efficiency on task, effective guidance, and the time and opportunity to do so, any serious student can learn what another knows.

### The Peer Group: Sine Qua Non

At the postsecondary level, there are students who have learned the social and academic hoops and those who haven't. The university system rewards the former and, although it does not overtly punish the latter, it ignores them, which is probably worse. But how did the former learn those hoops? Largely by emulating the academic attitudes and behavior of family members and peers. By attending college preparatory schools with children with similar goals to their own. It is certainly worth noting that students in college preparatory programs learn more than algebra and French. They learn how to dress, how to talk, how to interact with academics, and how to negotiate an academic system. In the SI and VSI sessions, students hear, some of them for the first time, that there are more and less appropriate ways to ask questions, more and less appropriate ways to engage faculty in discussion, more and less effective ways to prepare for examinations -- in short,

more and less effective ways to negotiate the shoals of academia. And with the support of their peer group, students gain the courage to act on their knowledge.

The central issue here with respect to at-risk students is not time on task. Weak students spend as much or more time in study than strong students (Stephen Smith, M.D., Associate Dean, Brown University School of Medicine, personal communication, 1995). The difference is in the relative efficiency of the time they devote to their studies. Students with a variety of aptitudes may encounter frustration both in lecture and in homework. Even an academically talented student may leave a lecture with an incomplete set of notes, go home to study alone with a textbook he may not fully comprehend, and give up. SI and VSI recognize that when students give up the homework in frustration, the fault is not in their character. In the SI and VSI approaches to instruction, the student leaves the peer group session and goes to the study table well prepared for what he is about to undertake. He understands the curriculum, and, not surprisingly, performs as well as his more advantaged peers. Those of us who engage in SI and VSI believe that the greatest benefit we can confer on our students is to help them to make their study time more productive than it might otherwise be. Initially capturing and managing students' study time -- the greatest unrecognized and wasted resource on the modern campus -- contributes significantly to their success.

Both the SI and VSI models act on the principle that telling doesn't help. Students need to experience the process of pursuing and achieving an academic goal before they can agree that the victory is in the struggle. Unfortunately, we are all influenced by those who would have us believe there is a fast track to education and to advancement as there may (or may not) be a Congressional fast track to international trade agreements. Our students, given the opportunity to struggle meaningfully with the stuff of academia, can, with the help of peers who are also struggling, find that pathway to self-realization.

Our contribution to the evolving paradigm of developmental education derives from the firm belief -- with data to support our claim -- that the essential content of developmental courses can be derived from formal curriculum. Students can join together to self-regulate and equilibrate within the academic mainstream.

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